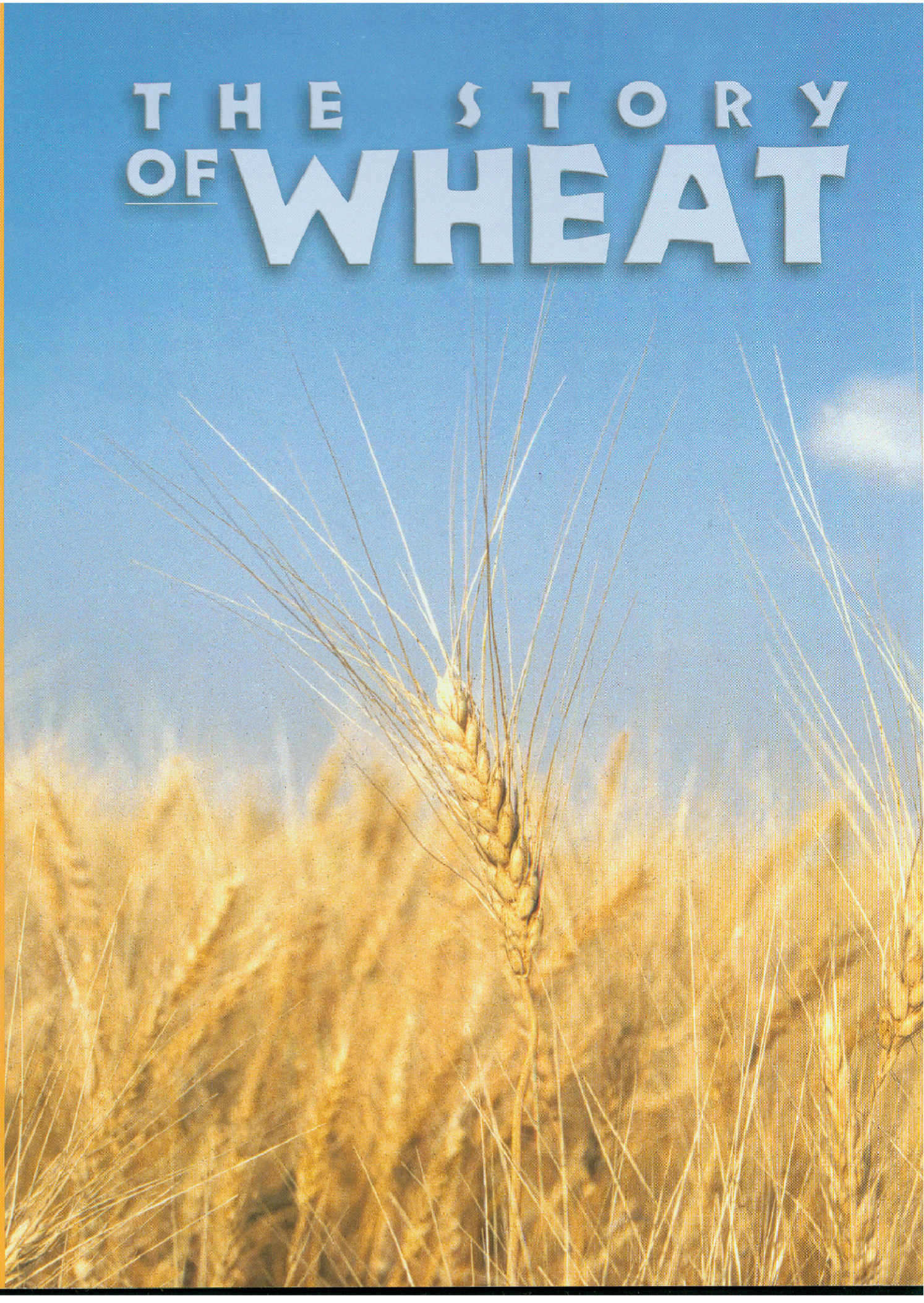
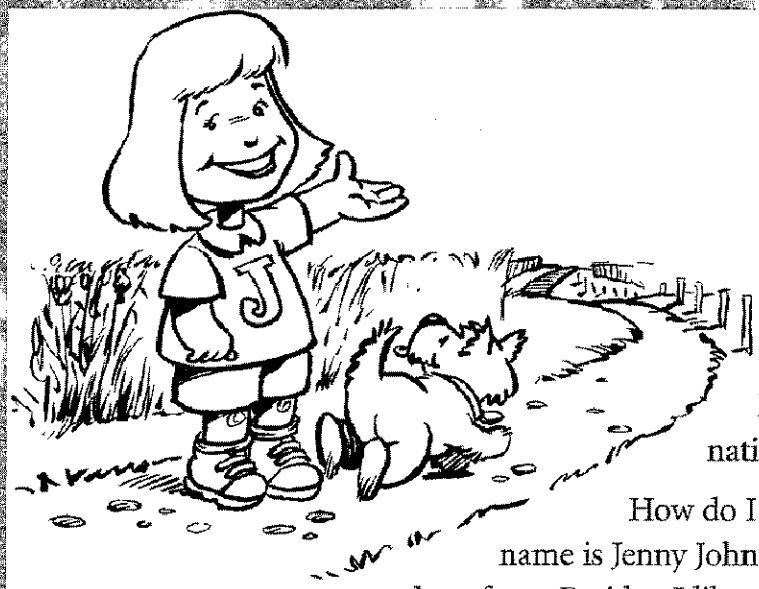
AN EDUCATIONAL ACTIVITY BOOK

THE STORY OF WHEAT





Have you ever been on a wheat farm? If you live in Montana, there's a good chance you have since there are more than 8,950 wheat farms in the state. In fact, Montana farmers produce on average 153 million bushels of wheat annually. Montana is usually third in the nation in total wheat production.

How do I know so much about wheat? My name is Jenny Johnson and I live on a Montana wheat farm. Besides, I like to eat bread, pasta, cereal, pretzels, licorice and a bunch of other goodies made with wheat.

You want to know more about wheat too? Well, come with me and you'll discover how farmers grow wheat and how this golden crop becomes the foods we love.

MEET THE KERNEL

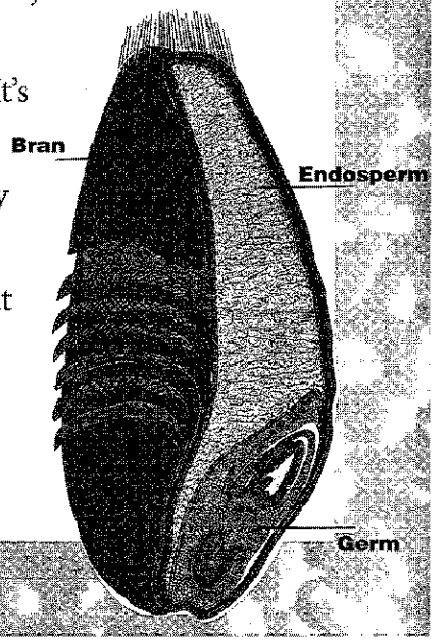
Here is a wheat **kernel,** or seed. It was enlarged so you can see how complicated one kernel is. Kernels are very tiny — even smaller than our little fingernails! There are about 50 kernels in a head of wheat and 15,000 to 17,000 kernels in just one pound!

The large, inner portion of the kernel is called the **endosperm.** It's the part that's ground to make white flour.

The hard, outer coating is the **bran.** This portion is made of many layers. Bran can be used in cereals or livestock and poultry feeds.

Finally, the tiniest part of the kernel is the **germ.** It's the part that grows into a new wheat plant if the kernel is planted. The germ is sometimes added to baked goods and casseroles.

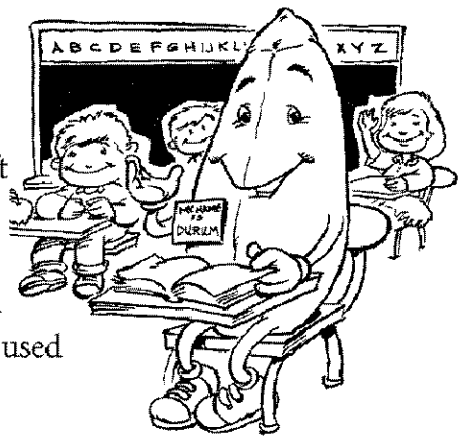
If all three parts of the kernel — endosperm, bran and germ — are **milled,** or ground, together, you get whole wheat flour.



WHEAT IS "CLASSY"

There are hundreds of varieties of wheat grown in the United States, but they are grouped into six classes based on hardness, color and time of planting. The six classes are hard red spring, hard red winter, hard white, soft red winter, soft white and durum wheats. Montana is unique. It raises all classes except soft red winter wheat.

Millers and bakers need to know what class of wheat they're using, since each makes a different type of flour and is used in different types of foods.



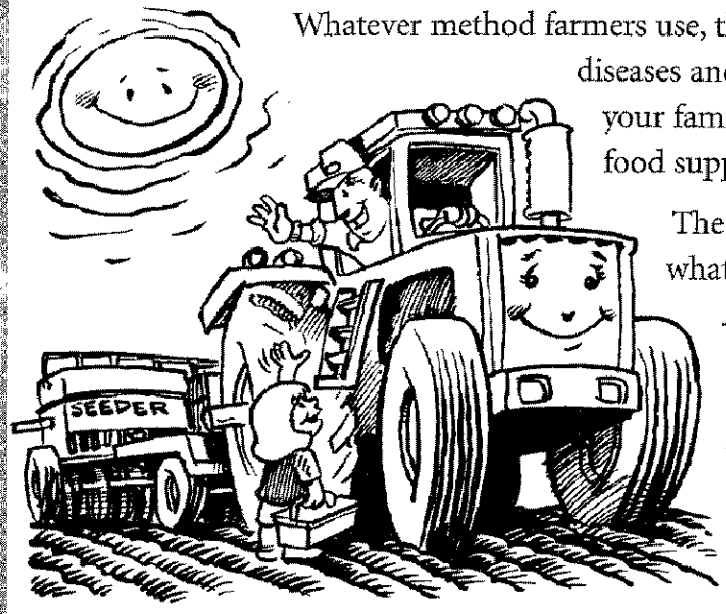
Hard wheats are used to make breads and rolls. The soft wheats are used in such goodies as cakes, pastries and crackers. Hard wheat or a combination of hard and soft wheats is blended to make all-purpose flour - most often used by home bakers. Durum, the hardest wheat of all, is used in pasta – macaroni, spaghetti, lasagna and more.

SOWING THE WAY

Because of the cold winters in our state, most wheat is **sowed,** or planted, in the spring – April or May – when the soil temperature is warm enough for the wheat to begin to grow, or **germinate.**

Long before the wheat can be planted, though, much work has to be done to prepare the soil. My mom and dad use a **field cultivator,** or **chisel plow,** pulled by a tractor to till the soil. Tillage is similar to hoeing a garden because it breaks the soil into small pieces and kills weeds that grow early in the spring. When a proper seedbed has been prepared, my parents plant wheat with a **grain drill.** The drill opens a furrow in the soil, drops the seed in at an even depth, covers the seed and packs the soil.

My uncle, Joe, prepares and plants his fields in a little different way. He uses a **no-till drill** that places the wheat seed in the soil without turning the soil over. This method of planting helps prevent the soil from **eroding,** or wearing away. It **conserves,** or saves, the soil and its nutrients.



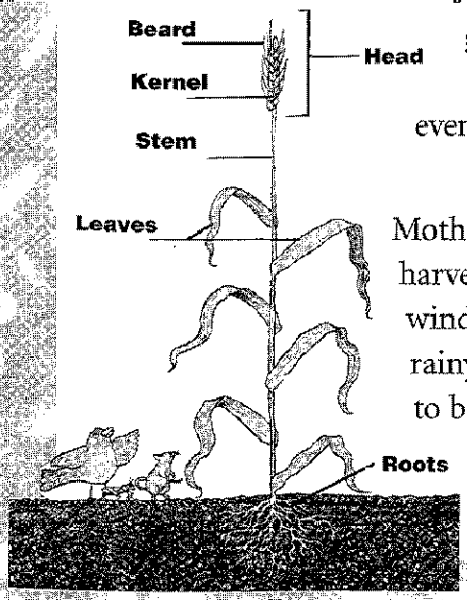
Whatever method farmers use, they work hard to fight insects, plant diseases and weeds in order to provide you and your family with a tasty, safe and abundant food supply.

The **moisture,** or water, in the soil is what makes the wheat plant start to grow. At first, the germ, or the growing part of the seed, gets its food from the endosperm. As the wheat grows taller, though, it gets food from the soil and through its roots. The wheat plant's green leaves also make food from the sunshine through a process called **photosynthesis.**

AMBER WAVES

Warm, moist days make the wheat plants grow quickly. They usually grow to be 2 to 4 feet high. A wheat plant has four basic parts: head, stem, leaves and roots. The **head** is what contains the kernels. The **stem** supports the head, the **leaves** conduct photosynthesis and the **roots** hold the plant in the soil.

In late June or early July, green wheat plants turn a rich, golden color. You know the song, "Oh beautiful for spacious skies, for amber waves of grain. . ." The song was written because a ripe wheat field is something beautiful to see. Who knows, the song may have even been written about a wheat field in Montana!



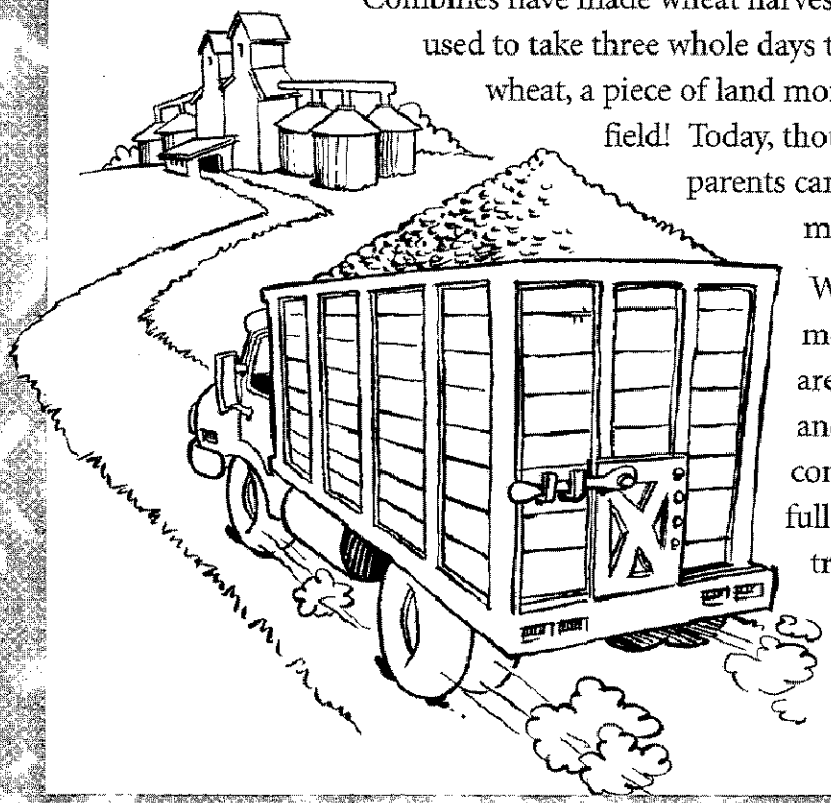
Farmers have to move fast when the wheat is ripe. While Mother Nature usually cooperates with them, my parents race to harvest the crop, because a ripe wheat field is an easy target for wind, rain, hail and even fire. Wheat can't be harvested if it's rainy. The moisture content of the wheat has to be dry enough to be stored without spoiling.

YOU GOT THE RIPE ONE, BABY

How do farmers know when the wheat is "just right" for harvest? Many farmers simply take a sample of wheat to the local elevator for testing. There the wheat is checked to see if it's dry enough to harvest. Other farmers, like my dad, check their wheat the "old-fashioned" way. They rub the wheat head in their hands, blow away the **chaff,** or the strawlike outer covering of the kernel, and chew some of the grain. If the kernels are hard and make a gummy substance as they are chewed, the farmers know the wheat is ready to be cut.

Because of all the different climates, wheat doesn't ripen at the same time everywhere in the United States. Harvest begins in May in hot, southern states like Texas and Oklahoma, and then moves north as the summer goes along. In Montana, harvest usually begins in late July and lasts until early September, about the time we start a new school year.

Wheat is harvested with a giant machine called a **combine.** It cuts, separates and cleans grain all at the same time. Before the combine was invented, my grandparents tell the story of how they had to use two separate machines for harvest — a reaper, or binder, to cut the grain and a threshing machine to separate the kernels from the chaff and stems. The combine is so named because it "combines" the jobs of both machines.



Combines have made wheat harvesting much faster and easier. It used to take three whole days to cut and thresh an **acre** of wheat, a piece of land more than half as large as a football field! Today, though, with a large combine, my parents can harvest an acre in less than six minutes!

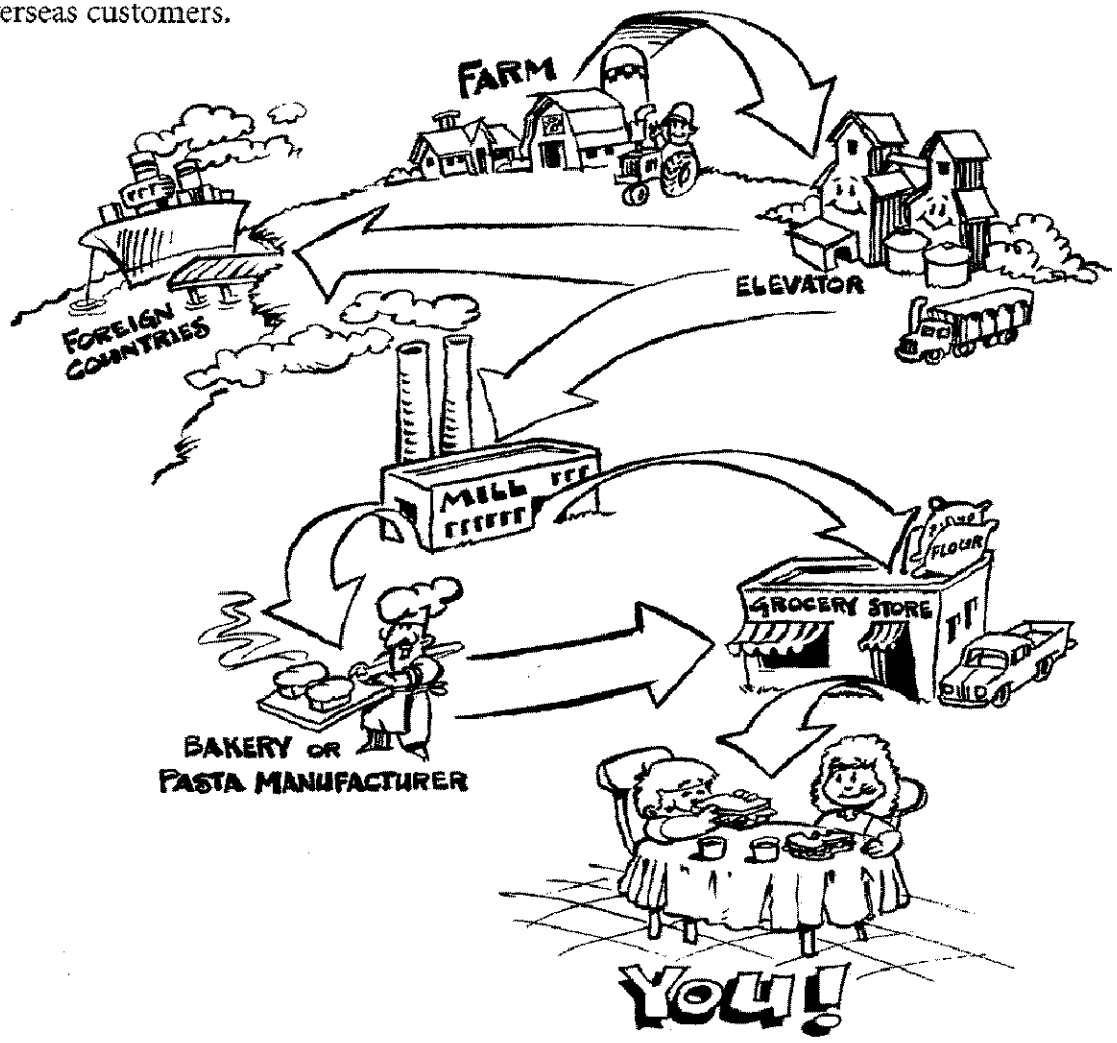
What exactly does "harvesting" mean? It means the wheat kernels are removed from the wheat plant and placed into a hopper on the combine. When the hopper gets full, the wheat is unloaded into a truck, which, at our farm, is usually driven by my older brother or sister. The grain is hauled to a storage bin on the farm or to a grain elevator.

TO MARKET, TO MARKET

The storage bin at a grain elevator sometimes looks like a giant white silo, but in Montana it is usually a large, silver building. The grain is emptied into a pit, and then raised or "elevated" into one of the tall bins. In my hometown of Wheaton, like many others, the grain elevator is the only skyscraper around!

At the elevator, each load of wheat is sampled and graded for quality. The price a farmer gets for the wheat depends on its grade, just like some of my friends' allowances depend on the grades they get in school! The better the grade, the more money the farmer receives.

From the elevator, the wheat may be sent by truck or train to a mill where it's ground to make flour for human foods. The type of flour produced depends upon what type of wheat it was made from. Or, the wheat may be sent to export facilities to be sent to overseas customers.



IT'S MAGIC!

Nothing tastes quite as good as a big slice of fresh bread right out of the oven! It's so soft, fluffy and chewy-good!

Flour can be made from other grains like rye, oats and barley too. Then why is wheat flour used most often in baking, you ask? The reason bakers choose wheat flour is because it contains a magical protein called **gluten.** Other grains have gluten too, but not as much as wheat.

I'll show you how gluten works, but first you need to know about another ingredient in bread called **yeast.** Besides flour, yeast is the most important thing in bread. Yeast is what makes bread **rise,** or increase in size.

When yeast is mixed with warm water and flour to make bread dough, the yeast gets "active" and makes thousands of tiny air bubbles. These bubbles need to be trapped in the dough so it will rise and become light. That's where the gluten comes in.

Gluten is very stretchy — sort of like bubble gum! The gluten traps the air bubbles from the yeast and keeps them in the dough. All the tiny holes in a slice of bread were formed by gluten bubbles.

Since other grains don't have as much gluten as wheat, bread made from other grains is heavy. Therefore, wheat flour is usually combined with other flours to make rye, pumpernickel, barley and other multi-grain breads.

THIRSTY EXPERIMENT

Gluten is a "thirsty protein" that soaks up a lot of water. You can see for yourself how much gluten there is in different kinds of flour with a simple experiment. You'll need 1 cup of wheat flour and 1 cup of rye or barley flour.

First, mix enough water with the flour to make a smooth, clay-like dough.

Next, mix exactly the same amount of water with the rye or barley flour and stir. What do you discover? The mixture stays sticky and wet because there isn't enough gluten in the other-grain flour to soak up the moisture like the wheat flour does.

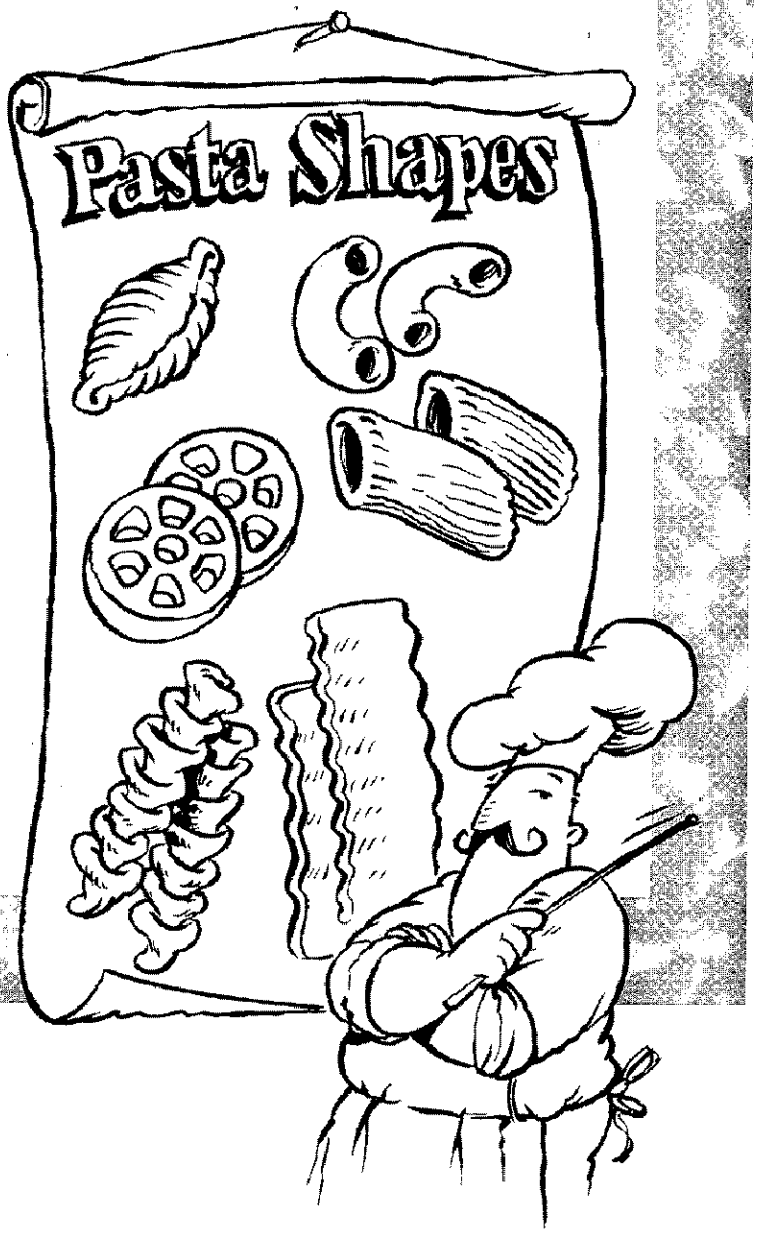
LOTSA PASTA

While hard red spring wheat is used to make breads, durum wheat is used to make pasta. "Pasta" is from the Italian word for paste — meaning a combination of flour and water. It's used to describe the 350 shapes and sizes of pasta products made from durum wheat.

Before durum can be used in foods, it must be milled into **semolina,** the coarsely ground endosperm of a durum wheat kernel. **Farina,** milled from hard red spring wheat, is sometimes blended with semolina to make lower quality pasta.

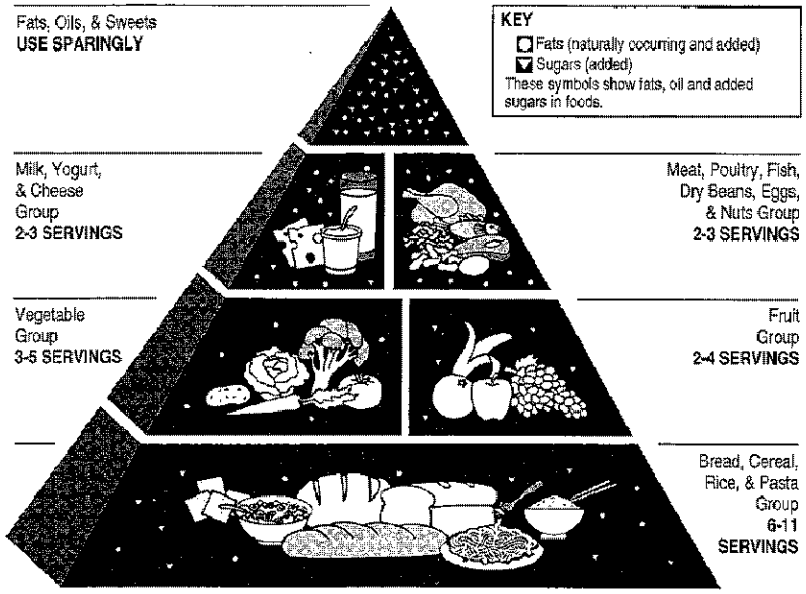
At a processing plant, semolina and water are mixed to make pasta dough. The dough is kneaded, and then forced through **dies,** or metal disks with holes, to create many pasta shapes. The size and shape of the holes in the dies determine the shape of the pasta. That's how pasta can be in flat ribbons, bows, sea shells, twists, corkscrews, cartwheels, grooved tubes, rings, stars, peppercorns and many other shapes that make eating noodles oodles of fun.

After being forced through the dies, the wet pasta is dried in special machines, packaged and sent off to the grocery store where you and your family buy the food to make your favorite dishes.



THE ENERGIZER

Food Guide Pyramid
A Guide to Daily Food Choices



SOURCE: USDA/HHS, 1993

Did you know more foods are made with wheat than any other cereal grain? It's true, and a good thing too, because wheat foods help fulfill the U.S. Department of Agriculture's daily dietary guidelines, which are illustrated by the Food Guide Pyramid. What is the **Food Guide Pyramid?** It's a guide to daily food choices and a nifty way to remember how to eat better (and feel better) all day long.

Here's how it works. At the base of the pyramid are the foods we should eat most often. They're bread, pasta, cereal and rice — a strong and delicious foundation for every good diet. Six to 11 servings are recommended daily, depending on your age and how active you are.

Wheat products provide **complex carbohydrates** which give our bodies the energy they need to run, play and work. Complex carbohydrates also help our brains function so we can get good grades in school.

Fiber is another strong point of wheat. It helps our digestive systems keep moving on schedule.

Many adults go on diets to lose weight and stop eating wheat products because they think those foods are fattening. They're wrong. Wheat foods are generally very low in fat and can actually help them lose weight. One slice of bread has just 65 to 70 calories.

Wheat also has **B-vitamins** and **iron** that aid in digestion, a good appetite and healthy nerves.

Athletes eat a lot of wheat products for these reasons. They know wheat foods will give them energy without many calories.

The next layer of the Food Guide Pyramid is made up of the fruit and vegetable groups. Ideally, we should have at least two to three servings from each every day.

The milk and meat groups are on the next level. We should have at least two to three daily servings from these groups as well.

Finally, at the top of the pyramid is the fat, oil and sweet section. Because these types of foods are allotted only a small amount of space on the pyramid, we know we are to eat them sparingly.

HOW LARGE IS A SERVING ANYWAY?

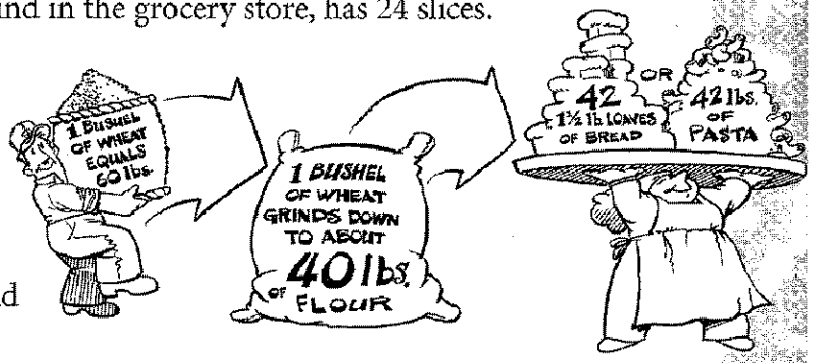
In the case of the bread group, here's a quick and easy guide to follow. One serving equals:

- ✔ 1 slice bread
- ✔ 1/2 bagel
- ✔ 1 slice pizza
- ✔ 3 cups popcorn
- ✔ 1/2 soft pretzel
- ✔ 1/2 cup rice
- ✔ 1/2 cup pasta
- ✔ 1 ounce of cereal
- ✔ 1 small waffle or pancake

BUSHELS OF FUN

Wheat is often bought and sold by the **bushel,** a unit of measurement for dry goods. A bushel of wheat weighs about 60 pounds when the farmer harvests the crop. From that one bushel, flour mills grind about 42 pounds of flour. Then, it goes to the baker who can make 42 one-and-a-half pound loaves of bread or pasta manufacturer who can make 42 pounds of pasta.

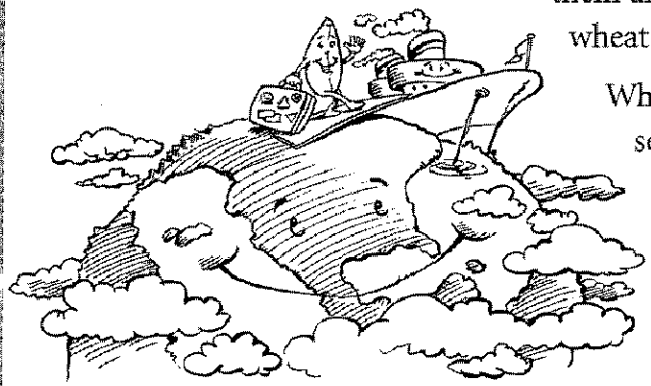
- One bushel of wheat yields 42 loaves of bread. The average one-and-a-half pound loaf, the size we usually find in the grocery store, has 24 slices.
- 24 slices x 42 loaves = 1,008 slices of bread. That's enough to make 504 sandwiches! If you ate a sandwich for breakfast, dinner and supper, it would take about 168 days to eat all the bread from one bushel of wheat!



WORLD CLASS TRAVELER

The wheat grown here and the rest of the United States travels to other countries so people there can eat wheat products, too.

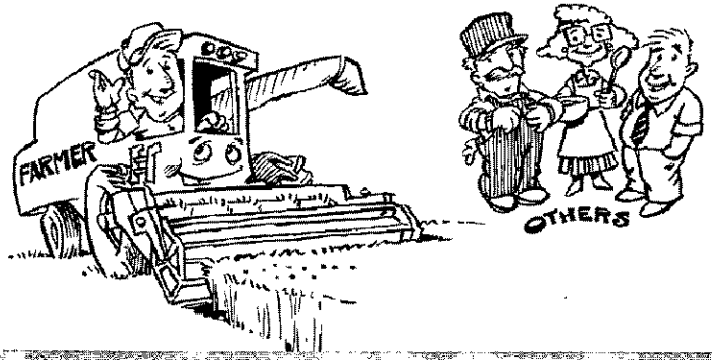
Not all children grow up eating bread like you and I. Instead, some eat mostly rice products. Wheat farmers in the United States send people to foreign countries to teach citizens there how to make wheat foods and to use bread, cereal and other wheat products in their daily diets. When these people realize wheat products are good for them and taste good too, their countries buy wheat from American farmers.



Wheat farmers must **export** their wheat, or sell it to other countries, because they raise more than we Americans can eat. In fact, each year, the United States sells about half the wheat we grow to more than 60 different nations around the world — everywhere from Japan to Venezuela.

WHO GETS THE DOUGH?

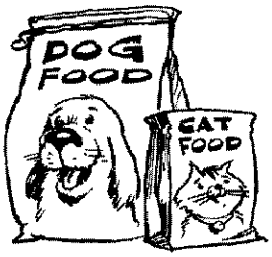
While wheat flour is the main ingredient in bread, the price of wheat has little to do with the price of bread. Did you ever wonder where the money goes when your family buys a loaf of bread at the supermarket?

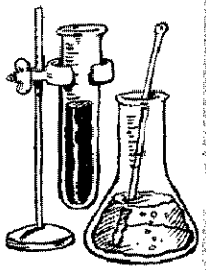


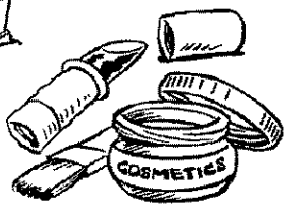
Today, a one-and-a-half pound loaf of wheat bread — the size we usually find in the grocery store — costs about $1.50. Of that amount, the farmer gets only 5 to 15 cents. The rest of the money goes to the flour miller, baker, trucker, grocer, and others.

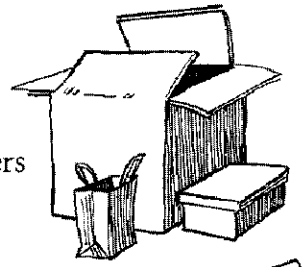
BEYOND THE TABLE

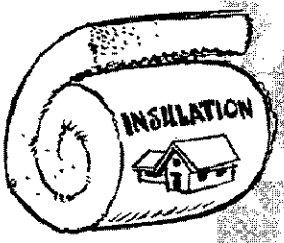
When you hear the word "wheat," do you automatically think of bread, pasta and other wheat foods? I know I do, because these treats are some of my favorite foods! But did you know that wheat can be used for things other than edible goods? Wheat and wheat straw have many alternative uses that make wheat such a valuable crop. All the items listed below can be made from wheat. Place an X beside those that you and your family use each day.

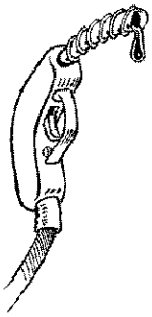


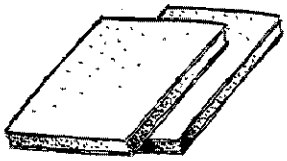












- ____ cosmetics
- ____ pet, livestock and fish feed
- ____ drugstore products
- ____ eating utensils
- ____ ethanol for gas purification
- ____ fiber board
- ____ food thickener
- ____ food trays and containers
- ____ genetic tests
- ____ insulation
- ____ packaging materials
- ____ paper
- ____ laundry soap
- ____ roofing and building materials
- ____ shooting targets
- ____ sweetener
- ____ trash bags

SUMMARY

Well, now that you know all about wheat, the crop my family raises on the farm, let's see what you remember about this important, versatile grain. Following are some activities to test your memory and wheat I.Q.!

ACTIVITIES

IDENTIFY THE PARTS

Fill in the blanks with the correct part(s) of the wheat kernel. You will use these words:

bran **endosperm** **germ**

_____ 1. I am the hard outer covering of the kernel.

_____ 2. I am the smallest part of the kernel.

_____ 3. I am the largest part of the kernel.

_____ 4. I am made of many thin layers.

_____ 5. I make white flour.

_____ 6. I am where the new wheat plant begins to grow.

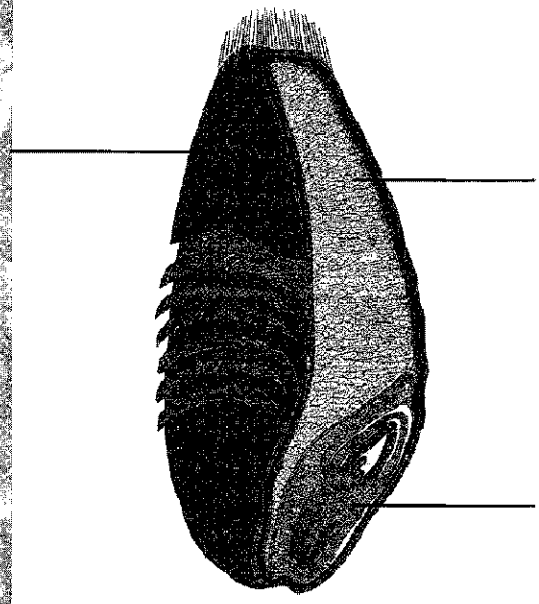
_____ 7. We make whole wheat flour.

_____ 8. I nourish the young plant when it starts to grow.

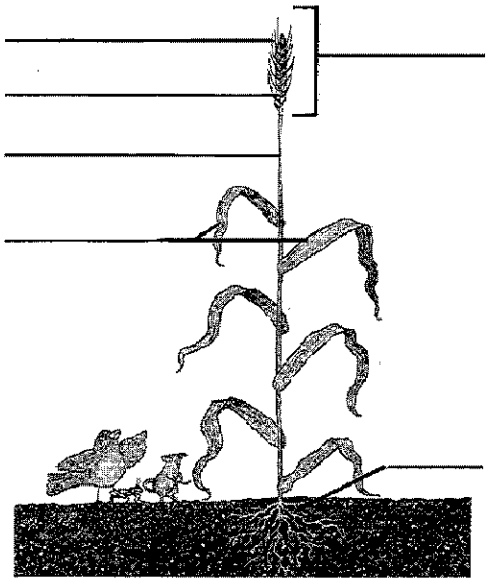
_____ 9. I am used in cereal flakes.

_____ 10. I am the part you touch when you hold a whole kernel of wheat.

Identify the **endosperm, bran** and **germ** of this wheat kernel?



Fill in the parts of the wheat plant: **leaves, head, roots, beard, stem, kernel**



SCRAMBLED TERMS

Unscramble these words.

1. **tproxe** — selling products to another country
2. **ceosnrev** — saving the soil
3. **htsnhsspooytei** — the way wheat plants make food using sunshine and soil nutrients
4. **drah dre sgrnip** — the class of wheat highest in protein and used to make yeast breads
5. **asniemol** — the coarsely-ground durum endosperm used to make pasta
6. **obnmeci** — cuts, separates and cleans grain all at the same time
7. **race** — a piece of land more than half as large as a football field
8. **draeg** — the price farmers receive for their wheat at the elevator depends on this
9. **mdruu** — class of wheat used to make pasta
10. **lubshe** — wheat is often bought and sold by this unit of measurement for dry goods

CROSS-OUT

Cross out the letters G, J, K, Q, U and Z to reveal all the good things wheat foods provide for your growing body.

G J C G O Q M P Z L E J X Z C K A K R B K O K H K Y D R G A J T E S Q U
G Z K J Q U F K I J B E G R Z Q U J K J L O K W J K F J A T Z J K Q U Z
K J G U Q G U V J I Q T A J M I N S K G J Z Q U Z J K Z J K Z U Q U Z J K
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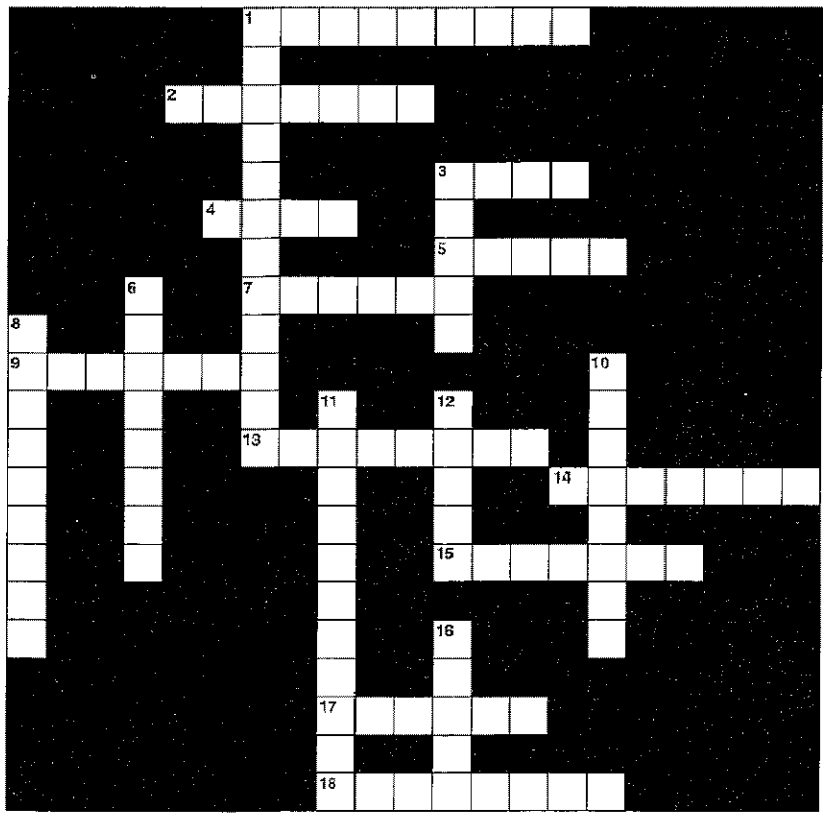
WHEAT FOODS CROSSWORD PUZZLE



Word Bank

gravy
sandwich
spaghetti
ravioli
pretzel
bread
licorice
pancake
buns
flour
macaroni
roll
bagel
waffle
lasagna
cereal
tortilla
Cream of Wheat
croissant
breadsticks

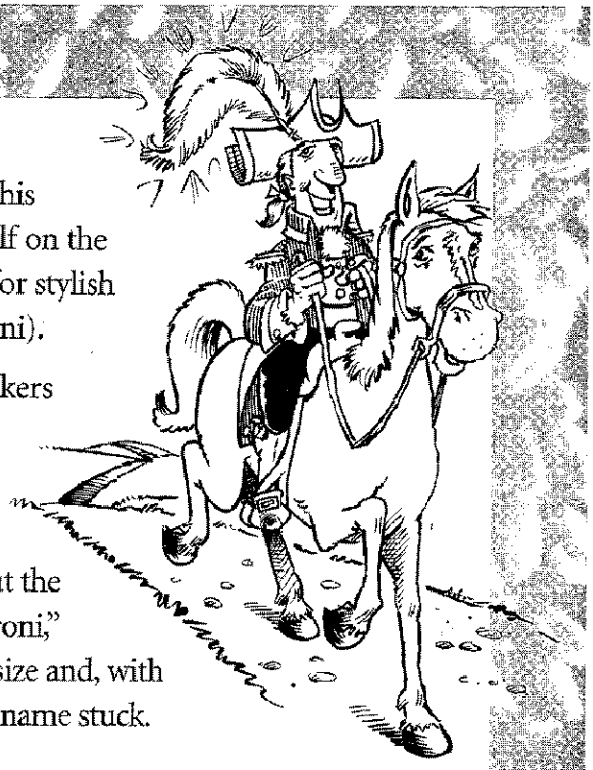
Across

1. A flaky, rich, crescent-shaped roll.
2. A salted snack food shaped like a bow.
3. Hamburgers and hot dogs are served on this bread.
4. A small, round loaf of bread eaten with a meal.
5. Eaten on mashed potatoes, rhymes with navy.
7. A breakfast food with square-shaped dents all over it.
9. Round and flat, this breakfast food is served with syrup
13. The outer covering of tacos.
14. A baked dish made of layers of broad, flat pasta, cheese, tomatoes and meat.
15. Small pockets of pasta filled with meat or cheese.
17. A breakfast food served in a bowl and covered with milk.
18. A peanut butter and jelly _____.

Down

1. A hot, cream-style cereal.
3. A hard, glazed, ring shaped roll; often spread with cream cheese.
6. A rope candy that is usually red, black or brown.
8. Long, skinny pasta shape often eaten with meatballs.
10. Curved, tubular pasta shape often served with cheese.
11. Long, narrow strips of bread often served with pasta and pizza.
12. Finely ground wheat kernels used to make bread.
16. Served toasted for breakfast.

NOODLE DOODLE



When in the late 1700s Yankee Doodle stuck a feather in his cap and called it macaroni, he was actually patting himself on the back for his fashion ingenuity, for "macaroni" was slang for stylish (the most chic and popular dish of the day being macaroni).

Legend has it that in the late 13th century, German bakers made large figures out of noodle dough in the shapes of men, stars, birds and sea shells, which they called collectively "dough men."

These bakers went to Genoa, Italy, to sell their product, but the Italians found them too expensive and exclaimed, "Ma caroni," meaning "but it's too dear." So the Germans reduced the size and, with the size, the price. They made a bundle of money and the name stuck.

PRETZELS

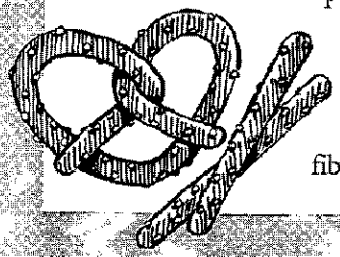
1 1/2 cups warm water (105-115° F)
2 packages active dry yeast
1/4 cup sugar
1/2 teaspoons salt
1/4 cup vegetable oil
4-4 1/2 cups bread or all-purpose flour, divided*
1 egg white
1 tablespoon water
sesame seeds or poppy seeds

*Up to two cups of whole wheat flour may be substituted.

Measure warm water into large bowl. Sprinkle in yeast; stir until dissolved. Add sugar, salt, oil and 3 cups flour; beat until smooth. Gradually add remaining flour to make a soft dough.

Knead dough by hand 10 minutes. Cover bowl and let rest 30 minutes. Divide dough into 24 pieces; cover and let rest 5 minutes. Roll each into a uniform 18-inch rope. Shape into a pretzel by making a circle, overlapping the two ends, twisting them once and then pressing them onto the bottom curve of the circle. (Dough may also be shaped into 8-inch breadsticks.)

Place on greased baking sheets. Beat egg white and water together; brush pretzels. Sprinkle with sesame or poppy seeds. Bake in a preheated, 425-degree oven for 12 to 15 minutes or until golden brown. Remove from baking sheets; cool on wire rack.



Nutritional Analysis. With 24 pretzels, each provides 108 calories (21 percent from fat), 2.4 grams protein, 2.5 grams fat, 19 grams carbohydrates, 0.7 grams fiber and 134 milligrams sodium.

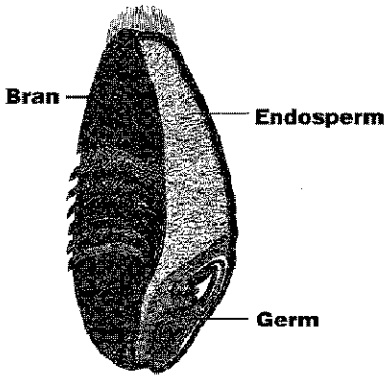
ANSWERS

IDENTIFY THE PARTS

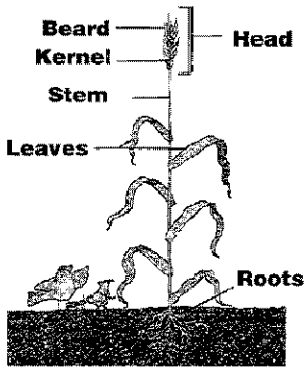
Wheat kernel parts

1. bran
2. germ
3. endosperm
4. bran
5. endosperm
6. germ
7. bran, germ, endosperm
8. endosperm
9. bran
10. bran

Wheat kernel diagram



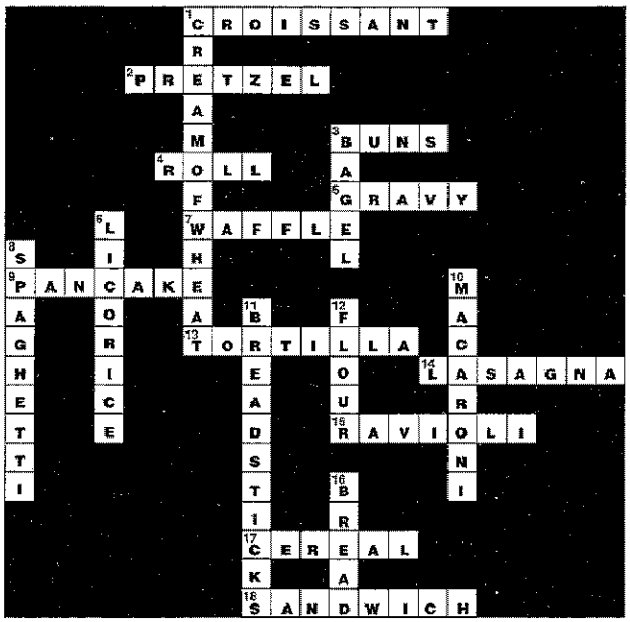
Wheat plant diagram



TERM UNSCRAMBLE

WHEAT FOODS CROSSWORD PUZZLE

1. export
2. conserve
3. photosynthesis
4. hard red spring
5. semolina
6. combine
7. acre
8. grade
9. durum
10. bushel



NUTRITION CROSS-OUT

G J **C** G **O** Q **M** **P** Z **L** **E** J **X** Z **C** K **A** K **R** **B** K **O** K **H** K **Y** **D** **R** G **A** J **T** **E** **S** Q U
G Z K J Q U **F** K **I** J **B** **E** G **R** Z Q U J K J **L** **O** K **W** J K **F** J **A** **T** Z J K Q U Z
K J G U Q G U **V** J **I** Q **T** **A** J **M** **I** **N** **S** K G J Z Q U Z J K Z J K Z U Q U Z J
K J K Q U Z U Q Z J K U Q Z U J K J G J K Q U Z **P** Z **R** J **O** **T** K **E** **I** J **N** G